Ammonia Standards and Regulations

Blaine Davis - Technical Services Manager
Airgas Specialty Products
Ammonia Standards and Regulations

- ANSI / CGA G-2.1 – Requirements for the Storage and Handling of Anhydrous Ammonia
- ANSI / IIAR – 2, 3, 4, 5, 7 & 8  (details next slide)
- State specific ammonia regulations
  - e.g. California Administrative Code Title 8
- CGA G-2 – Anhydrous Ammonia (reference)
ANSI / IIAR Ammonia Standards

2 Safe Design of Closed-Circuit Ammonia Refrigeration Systems
3 Ammonia Refrigeration Valves
4 Installation of Closed-Circuit Ammonia Refrigeration Systems
5 Start-up and Commissioning of Closed-Circuit Ammonia Refrigeration Systems
7 Developing Operating Procedures for Closed-Circuit Ammonia Refrigeration Systems
8 Decommissioning of Closed-Circuit Ammonia Refrigeration Systems
Hazardous Materials Standards & Regulations

- OSHA 1910.1200 – Hazard Communication
- NFPA 400 – Hazardous Materials Code
- NFPA 55 – Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks
Other Related Standards & Regulations

- 49 CFR Parts 100 to 199 – Transportation (DOT)
- API 510 Pressure Vessel Inspection Code
- National Board Inspection Code (NBIC)
- ASME B31.3 – Process Piping Code
- API 570 – Piping Inspection Code
- National Electric Code (NEC)
- OSHA General Duty Clause (GDC)
  - Clean Air Act Section 112(r)(1)
  - Facilities required to comply since 1990
General Duty Clause

• Owners and operators of facilities that have extremely hazardous substances are responsible for ensuring that these chemicals are managed safely

• **ALL** facilities that handle hazardous materials must comply – **No Threshold Quantity**

• Must take steps to both prevent accidental releases and to minimize the consequences of any accidental releases that may occur
  – Identify the hazards posed by the chemicals
  – Assess the impacts of possible releases
  – Design and maintain a safe facility
  – Minimize the consequences of accidental release
General Duty Clause Recommendations

• All facilities that use anhydrous or aqueous ammonia, regardless of the quantity on site, should:
  – Create & maintain P&IDs
  – Gather & maintain Process Safety Information (O&M Manuals, operating limits, etc.) for all equipment
  – Develop & maintain Safe Operating Procedures
  – Conduct & document a Process Hazard Analysis
    ▪ Document completion of resulting recommendations
  – Implement a Management of Change process
  – Conduct “annual” ammonia training for employees
  – Establish a Preventative Maintenance program
  – Establish an Emergency Response Plan
RAGAGEP

- RAGAGEP = Recognized And Generally Accepted Good Engineering Practices
- OSHA PSM Standard references RAGAGEP in 3 places:
  - (d)(3)(ii): Employers must document that all equipment in PSM-covered processes complies with RAGAGEP
  - (j)(4)(ii): Inspections and tests are performed on process equipment subject to the standard's mechanical integrity requirements in accordance with RAGAGEP
  - (j)(4)(iii): Inspection and test frequency follows manufacturer's recommendations and good engineering practice
RAGAGEP

• RAGAGEP applies to process equipment design and maintenance and inspection and test practices

• Examples of RAGAGEP
  – Widely adopted codes
    ▪ e.g. NFPA
  – Consensus documents
    ▪ CGA, IIAR, ASME that follow ANSI procedures
  – Non-consensus documents
    ▪ CGA, IIAR, ASME that do not follow ANSI procedures
    ▪ Applicable manufacturer's recommendations
  – Internal standards
    ▪ Must conform with other RAGAGEP sources
Use of RAGAGEP

- OSHA Process Safety Management (PSM) & General Duty Clause (GDC) are based on the use of Industry Standards / RAGAGEP

- EPA & OSHA Inspections and Investigations are based on compliance with Industry Standards / RAGAGEP

- Documentation of the RAGAGEP basis for all components of your compliance program is absolutely critical
  - Example: Airgas identified API 510 as the standard for pressure vessel inspections. Could have used NBIC or another standard.
GHS - Facts

- GHS is the acronym for the “Globally Harmonized System for the Classification and Labeling of Chemicals”
- Set of guidelines for ensuring the safe production, transport, handling, use and disposal of hazardous materials
- Developed by the United Nations
- Attempt to standardize hazardous materials standards and regulations internationally
- U.S. officially adopted the GHS in March 2012
- Revision of the OSHA Hazard Communication Regulation (1910.1200) titled “HazCom 2012”
GHS – “Observations”

- Most noticeable changes are to safety labels, safety data sheets, and chemical classification
- Primarily based on European standards
- Creates some conflicts in the U.S. with industry standards and practices that have been in place for decades
Labels

- Standardized elements that include specific language depending upon chemical classification
  - Pictograms
  - Signal Words
  - Hazard Statements
  - Precautionary Statements

- Typical packaging for Ammonia
  - Cylinders & DOT Portable Tanks
  - Bulk Storage Tanks
  - DOT Cargo Tanks (Bulk Delivery Bobtails, Trailers, Railcars)
    - No change to DOT placarding
AMMONIA, ANHYDROUS
(ANHYDROUS AMMONIA)

DANGER:
HARMFUL IF INHALED.
CONTAINS GAS UNDER PRESSURE. MAY EXPLODE IF HEATED.
CAUSES SEVERE SKIN BURNS AND EYE DAMAGE.
CORROSIVE TO RESPIRATORY TRACT.
FLAMMABLE GAS.
VERY TOXIC TO AQUATIC LIFE.

Use in accordance with ANSI/CGA G-2.1 and 29 CFR 1910.119. Do not breathe gas. Do not get in eyes, on skin, or on clothing. Use and store only outdoors or in a well ventilated place. Keep away from heat/open flames/sparks/hot surfaces - No Smoking. Eliminate all ignition sources if safe to do so. Leaking gas fire: do not extinguish, unless leak can be stopped safely. Use only with equipment of compatible materials of construction and rated for cylinder pressure. Use a back flow preventive device in the piping. Protect from sunlight when ambient temperature exceeds 52 °C/125 °F. Close valve after each use and when empty. Do not open valve until connected to equipment prepared for use. Wear protective gloves/protective clothing/eye protection/respiratory protection and/or face protection. Avoid release to the environment. Dispose of contents/container in accordance with container supplier/owner instructions. Do not handle until all safety precautions have been read and understood. Read and follow the Safety Data Sheet (SDS) before use. CAS: 7664-41-7

FIRST AID:
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if feeling unwell.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.
IF ON SKIN (OR HAIR): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. Immediately call a poison center or doctor/physician.
IF SKIN IRRITATION OCCURS: Get medical advice/attention.

DO NOT REMOVE THIS PRODUCT LABEL.
AMMONIUM HYDROXIDE

DANGER:
CAUSES SEVERE SKIN BURNS AND EYE DAMAGE.

Do not breathe mists. Wash hands thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Store locked up. Dispose of contents in accordance with federal, state and local regulations. Dispose of contents/container in accordance with container supplier/owner instructions. Avoid release to the environment. Do not handle until all safety precautions have been read and understood. Do not open valve until connected to equipment prepared for use. Read and follow the Safety Data Sheet (SDS) before use.

FIRST AID:

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a poison center/doctor/physician.

IF ON SKIN (OR HAIR): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before use. Immediately call a poison center/doctor/physician.

IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a poison center/doctor/physician.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.
Safety Data Sheets (SDS)

- MSDS (Material Safety Data Sheet) is now SDS

- GHS standardizes the content and formatting of SDSs into 16 sections with a strict ordering

- Each supplier has their own SDS, but it must follow the GHS format & include specific required information
OSHA Implementation Deadlines

• Compliant labels had to be in use on all containers & compliant SDSs had to be in use by all employers by June 1, 2015
Previous Airgas Anhydrous SDS

Airgas

Material Safety Data Sheet # 4601

Last Revision 09/21/12

Page 1 of 2

SECTION 1: CHEMICAL PRODUCT & COMPANY IDENTIFICATION

CHEMICAL NAME: Anhydrous Ammonia

TRADE NAMES / SYNONYMS: Ammonia

DISTRIBUTOR: Airgas Specialty Products

Transportation (Chicago)

Transportation (Canada: CANUTECH)

Environmental Health & Safety (24-hr):

1-800-528-4963

Customer Service (Tel/Fax):

1-800-508-2225

SECTION 2: COMPOSITION / INFORMATION ON INGREDIENTS

CHEMICAL FORMULA: % BY WEIGHT

CAS Registry No. 7681-51-5

OSHA PEL: 25 ppm (California only)

NIOSH REL: ACGH TLV

INHALATION: None

Ammonia NH₃ 0.5 99.955 7681-41-7 25 ppm (TWA) 25 ppm (TWA) 35 ppm (STEL) 300 ppm

Water H₂O 0.4 33 ppm 7732-18-5 None None None

Oil — 0.1 5 ppm None None None

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: 1. Colorless gas or compressed liquid with a purgant, suffocating odor. 2. Liquid ammonia reacts violently with water. Vapor cloud is toxic. 3. Avoid contact with liquid and vapor. 4. Stay upwind and use water spray to absorb vapor. 5. Not flammable under conditions likely to be encountered outdoors. 6. Do not inhale.

POTENTIAL HEALTH EFFECTS

ROUTE OF ENTRY: Inhalation, Skin Contact, Eye Contact, Ingestion, TARGET ORGANS: Eyes, skin and respiratory system.

EYE CONTACT: Exposure to liquid or high concentrations of vapor can cause pain, instant and possibly irreversible damage to tissue such as conjunctiva, cornea and lens. SKIN CONTACT: Prolonged contact with high concentrations can cause painful and serious chemical burns. INHALATION: Depending on exposure concentration and duration, effects can vary from none or only mild irritation to obstruction of breathing from large and bronchial spasms, to edema and severe damage to mucous membranes of the respiratory tract with possible fatal results. Latent edema and residual reduction in pulmonary function may occur. INGESTION: Tissue damage, chemical burns, nausea and vomiting can occur. Ammonia is a gas under normal atmospheric conditions and ingestion is unlikely. CARCINOGENICITY: NTP: No IARC: No OSHA: No

SECTION 4: FIRST AID MEASURES

EYE CONTACT: Flush with large amounts of water for at least 15 minutes then seek immediate medical aid.

SKIN CONTACT: Immediately flush with large quantities of water for at least 15 minutes while removing clothing. If clothing has frozen to skin, thaw with warm water before removing. Seek immediate medical aid.

INHALATION: Remove from exposure. If breathing has stopped or is difficult, administer artificial respiration or oxygen as needed. Seek immediate medical aid.

INGESTION: Do not induce vomiting. Have victim drink large quantities of water if Conscious. Immediately seek medical aid. Never give anything by mouth to an unconscious person.

SECTION 5: FIRE FIGHTING MEASURES

FLASH POINT (method used): Not Applicable FLAMMABLE LIMITS: 16-25% in air (for labeling purposes, not DOT flammable gas)

EXTINCTION METHODS: Water, Dry Chemical, Foam. Ammonia will burn in the range of 16-25% in air with a constant source of ignition. SPECIAL FIRE FIGHTING PROCEDURES: Move containers from fire zone if possible; if not, use water to cool fire containing container. Use water to control spray. Do not put water directly on liquid ammonia. Personnel must be equipped with appropriate protective clothing and respiratory protection.

NFPA HAZARD CLASSIFICATION: Health: 3 Flammability: 1 Reactivity: 0 (dashes = 4 highest)

SECTION 6: ACCIDENTAL RELEASE MEASURES

In US, federal regulations require that a release of 100 lb. or more of ammonia must be reported immediately to the National Response Center (at 800-424-8802), the ERC and the LEC. In California, all releases must be reported to CPUSA, state and local agencies. Additional state and local regulations may apply. SUGGESTED LOCAL ACTION: Stop leak if feasible. Avoid breathing ammonia. Evacuate personnel not equipped with protective clothing and equipment. Use copious amounts of water spray or fog to absorb ammonia vapor. DO NOT put water on liquid ammonia. Contain run-off to prevent ammonia from entering a stream. If inhalation of this material, during the course of loading, transporting, unloading or temporary storage, must be reported to U.S. DOT. as required by 49 CFR 171.15 and 171.16.

SECTION 7: HANDLING AND STORAGE

Refer to the ANSI K811.1 standard for storage and handling information. Protect containers from physical damage and temperatures exceeding 120°F. Use only approved storage systems. Zinc, copper, silver, cadmium, and their alloys must not be used in ammonia systems since they can be rapidly corroded by it. Avoid hydrostatic pressure, which can cause equipment rupture, by adhering to proper filling procedures and the use of pressure relief valves where appropriate.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

RESPIRATORY PROTECTION: Respiratory protection approved by NIOSH / MSHA for ammonia must be used when exposure limits are exceeded. Whether chemical canister respiratory or self-contained breathing apparatus is sufficient for effective respiratory protection depends on the type and magnitude of exposure.

SECTION 9: PHYSICAL & CHEMICAL PROPERTIES

BOILING POINT: 28.1°F SOLUBILITY IN WATER: High

SPECIFIC GRAVITY: 0.62 @ 60°F (water=1)

MEASURABLE VAPOR PRESSURE: 5.1 mm Hg at 71°F Molar Volume at 71°F 65.9 N m³/kg

PERCENT VOLATILE BY VOLUME: 100%

VAPOR PRESSURE: 4802.9 mm Hg @ 60°F or 107.6 psi

SECTION 10: STABILITY AND REACTIVITY

STABILITY: Material generally considered stable. Heating above ambient temperature causes rapid increase of vapor pressure.

INCOMPATIBILITY (materials to avoid): Ammonia can react violently with strong acids. Under certain conditions, ammonia reacts with chlorine, fluorine, or iodine to form compounds, which explode spontaneously. Reactions of ammonia with gold, silver or mercury to form explosive silver-like compounds has been reported.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen on heating to over 950°F. The decomposition temperature may be lowered to 75°F by contact with certain metals such as iron or nickel.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Not applicable.

SECTION 11: TOXICOLOGICAL INFORMATION

AMMONIA is a strong alkali and readily damages all body tissues. Ammonia is not a cumulative metabolic poison. Carcinogenicity, Reproductive, Mutagenicity, Teratogenicity: Effects is unknown. Aromatic amines are not anticipated. Synergistic Materials: None known.

SECTION 12: ECOLOGICAL INFORMATION

AQUATIC TOXICITY: 2.0-2.5 mg/l 4 days goldfish and yellow perch, LC₅₀

WATERFOWL TOXICITY: 120 ppm 60-80 ppm 3 days, crayfish, Cock.

BIODEGRADATION / BIOCHEMICAL OXYGEN DEMAND: Not pertinent 8 ppm (500 mg/l) within minutes

FOOD CHAIN CONCENTRATION POTENTIAL: None

SECTION 13: DISPOSAL CONSIDERATIONS

Recover ammonia as feasible. Otherwise, let ammonia evaporate if appropriate. Only personnel experienced in ammonia spills should add water to liquid ammonia. Consult local, state or federal regulatory agencies for acceptable disposal procedures and disposal locations. For Hazardous Waste Regulations call (800) 424-9346, the RCRA hot line.

SECTION 14: TRANSPORT INFORMATION

DOMESTIC SHIPMENTS

International Shipment

Prosper shipping name: Ammonia, Anhydrous

Shipping Class: 2.2 (nonflammable gas)

Identification number: UN1010

Packaging Group: None

Canadian TDG act

Ammonia, Anhydrous

Shipping Class: 2.3 (poison gas)

Identification number: UN100

Packaging Group: None

SECTION 15: REPORTING INFORMATION

NOTICE: This product is subject to the reporting requirements of SARA (1986), Section 313 of Title III and 40 CFR Part 370. Be sure to verify with state and local regulations.

CERCLA/SUPERFUND, 40 CFR 117.302: Unreported releases of 100 lb. or more of ammonia in any 24-hour period must be reported immediately to the ERC at 800-424-8802, the SERC and the LEC. Written report is required to be submitted to ERC and LEC.

OSHA HAZARD COMMUNICATION RULE, 1910.1200: Ammonia is considered a hazardous chemical.

TOTAL SUBSTANCE CONTROL ACT: This material is listed in the TSCA Inventory.

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT (SARA, TITLE III): This product is a hazardous substance. Yes: Section 311/312 Hazardous Categories: Immediate (Acute) Health Hazards: Section 313 Toxic Chemical. Yes

WMBE: One percent (1%) CALIFORNIA PROPOSITION 85: Reproductive. No

CARCINOGEN: No

OSHA PROCESS SAFETY MANAGEMENT, 29 CFR 1910.119: This product is subject to the Process Safety Management requirements of 29 CFR 1910.119 if maintained on-site in quantities of 10,000 lb. or greater.

EPACT: N/A

ACCIDENTAL RELEASE PREVENTION CRR, 40 CFR PART 68: This product is subject to the Risk Management Plan requirements of 40 CFR Part 68 if maintained on-site in quantities of 10,000 lb. or greater.

DRINKING WATER: Maximum use dosage is 50 parts water to 1 ppm.

SECTION 16: OTHER INFORMATION


Update Disposal information under Section 13 9. Shipping Class changed for Canadian TDG ACT under Section 14

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SKIN PROTECTION: Rubber gloves and rubber or other types of approved protective clothing should be used to prevent skin contact because liquid ammonia should be considered for increased protection from contact with liquid.

EYE PROTECTION: Chemical splash goggles, approved for use with ammonia, must be worn to prevent eye contact with liquid or vapor. Ammonia shields should be used for increased protection from contact with liquid.

VENTILATION: Local positive pressure and/or exhaust ventilation should be used to reduce vapor concentrations in confined spaces. Ammonia vapor being lighter than air, can be expected to dissipate to the upper atmosphere. Ammonia concentrations may also be reduced by the use of an appropriate absorbent or respirator, with or without activated charcoal.

An Air Liquide company
# Current Airgas Anhydrous SDS

**Section 1: Identification**

- **Product identification**: anhydrous sodium hydroxide (NaOH)
- **UN number**: 3256
- **CAS number**: 1310-73-2
- **EC number**: 233-022-6
- **EINECS number**: 205-137-3
- **NAI number**: 10093000

**Section 2: Hazard identification**

- **Hazard class and category**: Unspecified.
- **Labels**: Corrosive, skin damage, eye damage, respiratory irritation, toxic if inhaled.

**Section 3: Composition/Information on ingredients**

- **Chemical formula**: NaOH
- **Reactivity**: Reacts violently with organic substances.

**Section 4: First aid measures**

- **Inhalation**: Remove to fresh air. If not breathing, give artificial respiration.
- **Eye contact**: Rinse with water for 15 minutes. Seek medical attention.
- **Skin contact**: Wash with soap and water. Seek medical attention.

**Section 5: Fire fighting measures**

- **Extinguishing media**: Water, foam, dry chemical, CO2.
- **Special hazards**: Steam can be dangerous.

**Section 7: Handling and storage**

- **Stability**: Stable in dry conditions.
- **Precautions for storage**: Store in a dry, well-ventilated area.

**Section 8: Exposure controls/personal protection**

- **Exposure limits**: Not applicable.
- **Personal protective equipment**: Respiratory protection, gloves, eye protection.

**Section 9: Physical and chemical properties**

- **Physical state**: Solid
- **Appearance**: White crystalline
- **Odor**: None detected

**Section 10: Stability and reactivity**

- **Reactivity**: Reacts violently with acids, some metals.

**Section 11: Toxicological information**

- **Toxicological effects**: Corrosive, eye damage, skin irritation, respiratory irritation.

**Section 12: Ecological information**

- **Biodegradability**: Not biodegradable

**Section 13: Disposal considerations**

- **Disposal method**: Follow local regulations.

**Section 14: Transport information**

- **Transport risk class**: Not applicable.
- **UN number**: 3256

**Section 15: Regulatory information**

- **Regulatory status**: No specific regulations.

**Section 16: Other information**

- **Suppliers' emergency telephone number**: Contact supplier for emergency services.
Airgas Anhydrous SDS

SAFETY DATA SHEET
Ammonia

Section 1. Identification

GHS product identifier : Ammonia
Chemical name : ammonia, anhydrous
Other means of identification : ammonia; anhydrous ammonia; Aqueous ammonia; Aqua ammonia
Product use : Synthetic/Analytical chemistry.
Synonym : ammonia; anhydrous ammonia; Aqueous ammonia; Aqua ammonia
SDS # : 001003
Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA, 19087-5283
1-610-687-5253
24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture : FLAMMABLE GASES - Category 2
GASES UNDER PRESSURE - Liquefied gas
ACUTE TOXICITY (inhalation) - Category 4
SKIN CORROSION/IRRITATION - Category 1
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
AQUATIC HAZARD (ACUTE) - Category 1

GHS label elements : Hazard pictograms
Signal word : Danger
Hazard statements : Flammable gas.
Contains gas under pressure, may explode if heated.
May cause frostbite.
May form explosive mixtures in Air.
Harmful if inhaled.
Causes severe skin burns and eye damage.
Very toxic to aquatic life.

Precautionary statements
General : Read and follow all Safety Data Sheets (SDS) before use. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.
Prevention : Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Avoid breathing gas. Wash hands thoroughly after handling.
Section 2. Hazards identification

OSHA/HCS status: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

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- FLAMMABLE GASES - Category 2
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GHS label elements
Hazard pictograms:

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- May form explosive mixtures in Air.
- Harmful if inhaled.
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- Very toxic to aquatic life.

Precautionary statements
General:
- Read and follow all Safety Data Sheets (SDS’S) before use. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention:
- Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Avoid breathing gas. Wash hands thoroughly after handling.
Section 4. First aid measures

Description of necessary first aid measures

Section 5. Fire-fighting measures

Extinguishing media
Suitable extinguishing media

Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media

None known.

Specific hazards arising from the chemical

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. This material is very toxic to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Section 6. Accidental release measures
Section 7. Handling and storage

**Precautions for safe handling**

**Protective measures**

- Put on appropriate personal protective equipment (see Section 8).
- Contains gas under pressure. Do not get in eyes or on skin or clothing.
- Do not breathe gas. Avoid release to the environment. Use only with adequate ventilation.
- Wear appropriate respirator when ventilation is inadequate.
- Do not enter storage areas and confined spaces unless adequately ventilated.
- Store and use away from heat, sparks, open flame or any other ignition source.
- Use explosion-proof electrical (ventilating, lighting and material handling) equipment.
- Use only non-sparking tools.
- Empty containers retain product residue and can be hazardous.
- Do not puncture or incinerate container.
- Use equipment rated for cylinder pressure.
- Close valve after each use and when empty.
- Protect cylinders from physical damage; do not drag, roll, slide, or drop.
- Use a suitable hand truck for cylinder movement.

Section 8. Exposure controls/personal protection

**Appropriate engineering controls**

- Use only with adequate ventilation.
- Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits.
- Use explosion-proof ventilation equipment.
Section 9. Physical and chemical properties

Lower and upper explosive (flammable) limits
Lower: 15.4%
Upper: 25%

Auto-ignition temperature: 651°C (1203.8°F)

Section 10. Stability and reactivity

Section 11. Toxicological information

Section 12. Ecological information

Section 13. Disposal considerations

Section 14. Transport information

Section 15. Regulatory information
Section 16. Other information

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Flammability
Health
Instability/Reactivity
Special
**Flammability “Discussion”**

- Flammability Range
  - Differs by source
  - Airgas SDS: 15.4% - 25% concentration in air
  - Other sources range from 12% LFL - 28% UFL

- Indoor vs. Outdoor Installation

- Past 125 years vs. Now
  - Past – Outdoor – General Purpose Electrical Class
  - Airgas SDS now based on GHS
    - Category 2 Flammable Gas
    - Explosion Proof Equipment
Flammability “Discussion”

- Ammonia is a Category 2 Flammable Gas

From OSHA 1910.1200 Appendix B

B.2 FLAMMABLE GASES

B.2.1 Definition

Flammable gas means a gas having a flammable range with air at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi).

B.2.2 Classification criteria

A flammable gas shall be classified in one of the two categories for this class in accordance with Table B.2.1:

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gases, which at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi): (a) are ignitable when in a mixture of 13% or less by volume in air; or (b) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit.</td>
</tr>
<tr>
<td>2</td>
<td>Gases, other than those of Category 1, which, at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi), have a flammable range while mixed in air.</td>
</tr>
</tbody>
</table>

NOTE: Aerosols should not be classified as flammable gases. See B.3.

B.2.3 Additional classification considerations

Flammability shall be determined by tests or by calculation in accordance with ISO 10156 (incorporated by reference; See §1910.6). Where insufficient data are available to use this method, equivalent validated methods may be used.
Established in 1971 by the chemical industry as a public service hotline for emergency responders to obtain information and assistance for emergency incidents involving chemicals and hazardous materials.

Registration with CHEMTREC authorizes shippers of hazardous materials the right to portray the CHEMTREC phone number on their shipping documents, Safety Data Sheets (SDS) and hazard communications labels.

Helps registrants to comply with government regulations, such as DOT 49 CFR § 172.604, which requires shippers of hazardous materials to provide a 24-hour emergency telephone number on shipping documents.
• Round-the-clock communications center staffed by trained and experienced emergency service specialists
• Access to database of over 30,000 manufacturers, shippers, carriers, public organizations and private resources
• State-of-the-art telecommunications system
• Library of over 6 million SDSs
• Database of medical experts
• Interpretation capabilities for more than 200 languages